

Puget Sound salinity: why it matters

by Kimberle Stark

Puget Sound salinity has been higher in 2019 than normal. Salinity refers to the amount of dissolved salt in the water. Why is it important to know the salinity of Puget Sound waters? Before answering this question, we first need to understand the features that make Puget Sound unique and their influences on how water moves in, out, and within the Sound.

Puget Sound is a fjord estuary, meaning it was formed by glaciers. At the end of the last ice age, about 13,000 years ago, as the glaciers advanced and retreated, they carved out narrow, deep valleys that filled with water. All estuaries, including Puget Sound, are partially closed-off waterbodies where freshwater from rivers and streams mixes with salt water from the ocean.

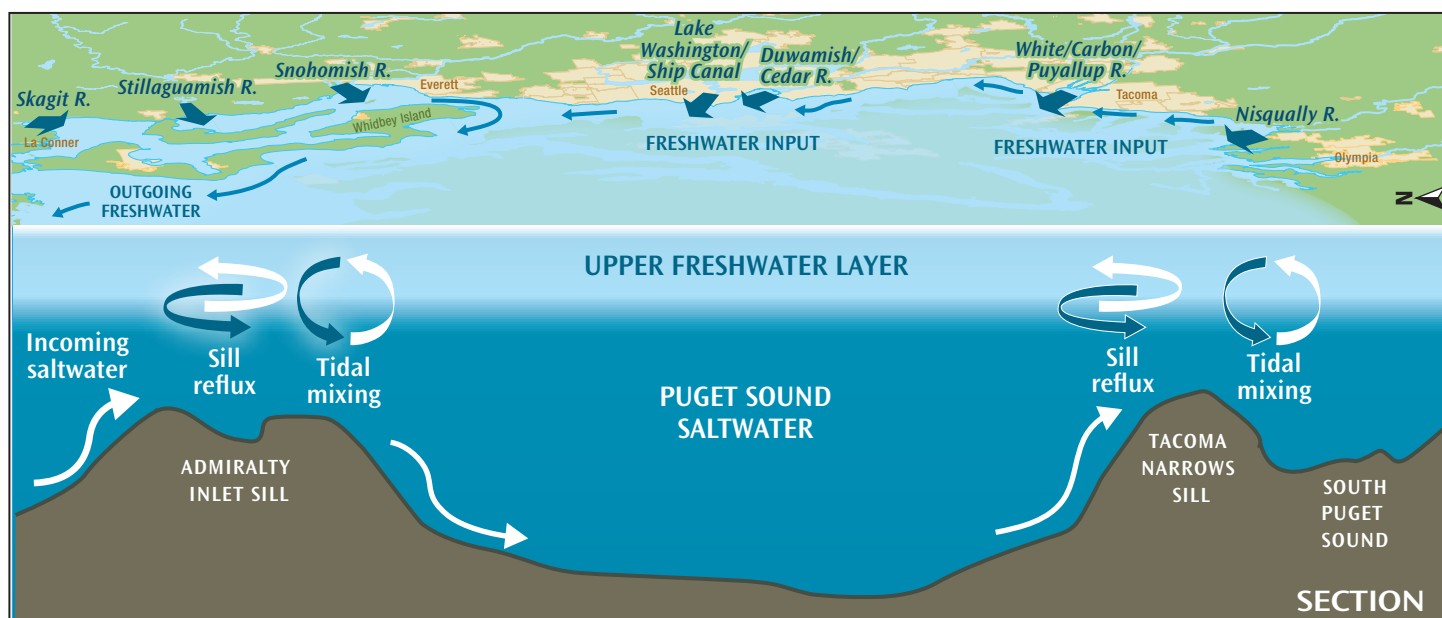
Puget Sound consists of four separate but interconnected basins named the Main Basin (subdivided into Admiralty Inlet and the Central Basin), Whidbey Basin, Hood Canal, and South Sound. These basins are separated by underwater

ridges, or sills that can block water movement and mix waters across depths. King County marine waters are located within the Central Basin, the area from Admiralty Inlet to Commencement Bay in Tacoma.

Water continually circulates in and out of Puget Sound and is influenced by tidal currents. Because of the Admiralty Inlet and Tacoma Narrows sills, only a portion of the water flows out at any one time (Figure 1). Dense and salty Pacific Ocean water enters Puget Sound at depth through Admiralty Inlet, while the less dense, fresher water flows out of Puget Sound near the surface. So why is salinity important? Salinity has a strong influence on water density, which affects how water circulates and mixes between the top and bottom of the water column and it affects how marine organisms move in the water column. For example, microscopic marine algae, or phytoplankton, are the base of the food web. Phytoplankton need to remain near the surface to get the light they need to grow and reproduce. When density is

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Figure 1. General illustration of circulation and movement of salt and fresh water in Puget Sound.



similar throughout the water column, phytoplankton have a hard time remaining near the surface. Differences in the density of the water column can also affect the location and dispersal of other organisms, like zooplankton and fish larvae. In addition to affecting living creatures, salinity is also important because it indicates how much freshwater is coming from rivers and rainfall as well as the influence of the Pacific Ocean.

The King County Marine Monitoring Program measures salinity twice a month at 14 locations within the Central Basin. Since February 2019, salinities throughout the Central Basin and most of the entire water column have been higher than normal when compared to the last 10 years. Figure 2 shows this situation in an example from Pt. Jefferson, located in the northern portion of the county. Figure 3 shows salinity at Pt. Jefferson from January through August compared to the difference (anomaly) from the historical average. As you can see, salinity has been higher than normal.

Why is the Sound so salty?

One key reason is the unusually dry weather we had in 2019. January 2019 rainfall was almost two inches below normal, while March was the second driest on record and the driest in the last five decades. This was followed up by less than normal rainfall in May and June. Less rainfall means less freshwater runoff and lower river flows, which means higher salinity at the surface of Puget Sound. It also means that water density is more similar between the top and bottom of the water column and waters mix more.

Increased mixing of surface and deep waters makes it harder for marine algae to stay near the surface. This has impact on plankton and could cause problems for animals higher up in the food web, like fish and marine birds. In addition, the changes in circulation patterns could alter the location and amount of nutrients, dissolved oxygen, and pollutants in the water column. This is why King County works hard to measure and understand trends in the salinity of Puget Sound and why salinity matters.

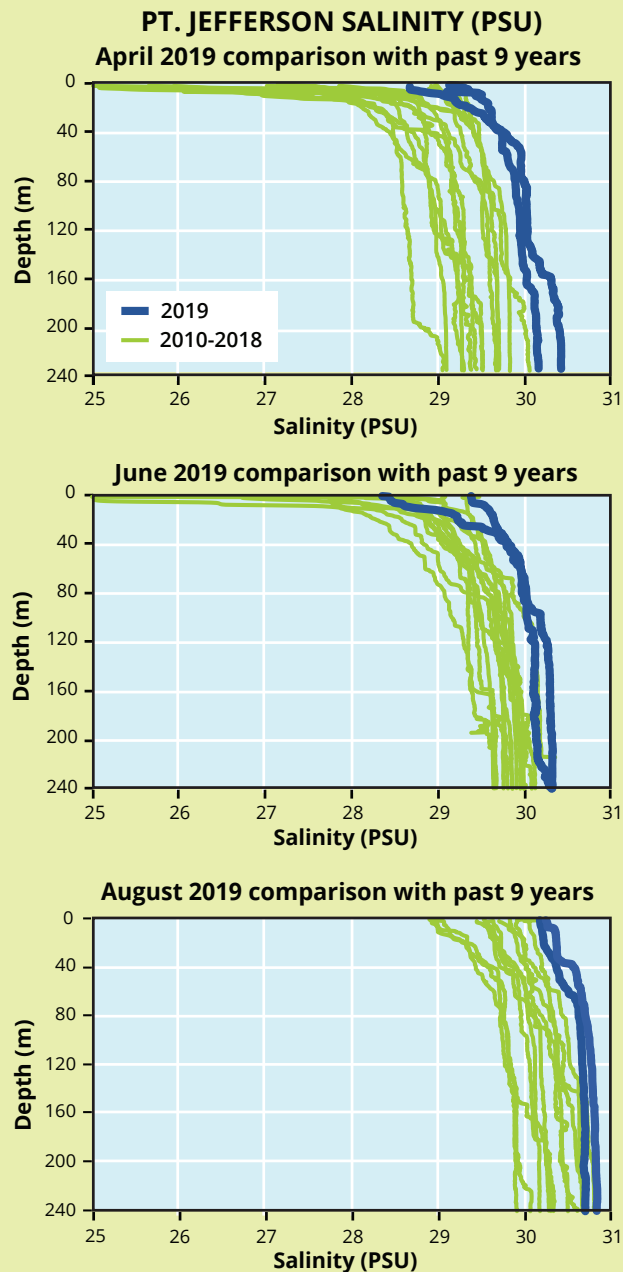


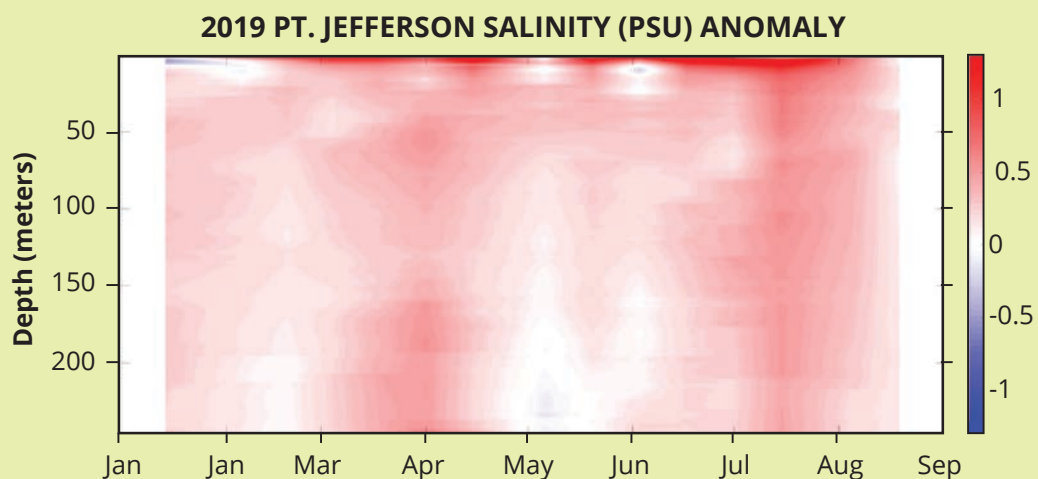
Figure 2 (right).

2019 salinity (shown in dark blue) in April, June and August, at one location compared to results from the past nine years.

PSU=practical salinity unit.

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Figure 3 (right).
2019 salinity at one location compared to the difference in the historical average (1999-2013). Red indicates higher than normal and blue lower than normal. Plot created by Stephanie Jaeger.



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